AMENDMENTS TO THE CLAIMS

This listing of claims will replace all prior versions and listings of claims in the application:

LISTING OF CLAIMS:

1. (currently amended): A spatial motion recognition system, comprising:

a motion detection unit for outputting position changes of a body of the system in space as an electric signal based on three-dimensional motions of the system body; ~~and~~

a control unit for receiving the electric signal outputted from the motion detection unit, wherein the control unit~~which~~:

tracks the three-dimensional motions of the system body based on the electric signal outputted from the motion detection unit,

produces a virtual handwriting plane located in three-dimensional space, wherein a location of the virtual handwriting plane is a plane which is most adjacent to a set of respective points which correspond ~~having the shortest distances with respect to respective positions corresponding~~ to the tracked three-dimensional motions of the system body in predetermined time intervals, and

projects the respective ~~positions~~points corresponding to the tracked three-dimensional motions of the system body in the predetermined time intervals onto the virtual handwriting plane as motion tracks,

carries out a rotation conversion of the motion tracks projected on the virtual handwriting plane into a two-dimensional plane of x and y axes; and

a display unit for displaying the two-dimensional plane outputted by the control unit

~~wherein the virtual handwriting plane is produced based on the tracked three-dimensional motions of the system body~~.

2. (currently amended): ~~The~~A spatial motion recognition system, comprising: ~~as claimed in claim 1~~

a motion detection unit for outputting position changes of a body of the system in space as an electric signal based on three-dimensional motions of the system body; and

a control unit for tracking three-dimensional motions of the system body based on the electric signal outputted from the motion detection unit, producing a virtual handwriting plane having the shortest distances with respect to respective positions in predetermined time intervals based on three-dimensional track information obtained through tracking, and projecting the respective positions in the predetermined time intervals onto the virtual handwriting plane to recover the motions in space,

wherein the control unit calculates the virtual handwriting plane having the shortest distances with respect to positions in the predetermined time intervals, using the following equation:

$$\begin{bmatrix} \sum_{i=1}^{m} x_i^{\,2} & \sum_{i=1}^{m} x_i y_i & \sum_{i=1}^{m} x_i \\ \sum_{i=1}^{m} x_i y_i & \sum_{i=1}^{m} y_i^{\,2} & \sum_{i=1}^{m} y_i \\ \sum_{i=1}^{m} x_i & \sum_{i=1}^{m} y_i & m \end{bmatrix} \begin{bmatrix} \alpha \\ \beta \\ \gamma \end{bmatrix} = \begin{bmatrix} \sum_{i=1}^{m} z_i x_i \\ \sum_{i=1}^{m} y_i z_i \\ \sum_{i=1}^{m} z_i \end{bmatrix}$$

wherein (x_i, y_i, z_i) are coordinates of the system body that is tracked at a predetermined time in three-dimensional space, and α, β, and γ are parameters for the virtual handwriting plane.

3. (currently amended): ~~The~~A spatial motion recognition system~~ as claimed in claim 1~~, comprising:

a motion detection unit for outputting position changes of a body of the system in space as an electric signal based on three-dimensional motions of the system body; and

a control unit for tracking three-dimensional motions of the system body based on the electric signal outputted from the motion detection unit, producing a virtual handwriting plane having the shortest distances with respect to respective positions in predetermined time intervals based on three-dimensional track information obtained through tracking, and projecting the respective positions in the predetermined time intervals onto the virtual handwriting plane to recover the motions in space,

wherein the control unit calculates tracks of the positions in the predetermined time intervals that are projected onto the virtual handwriting plane by the following equation:

$$x_i' = x_i - \frac{a(ax_i + by_i + cz_i + d)}{a^2 + b^2 + c^2}$$

$$y_i' = y_i - \frac{b(ax_i + bx_i + cz_i + d)}{a^2 + b^2 + c^2}$$

$$z_i' = z_i - \frac{c(ax_i + bx_i + cz_i + d)}{a^2 + b^2 + c^2}$$

wherein (x_i, y_i, z_i) are three-dimensional coordinates when the electric signal obtained based on motion occurrences of the system body in the three-dimensional space is divided in the predetermined time intervals, (x_i', y_i', z_i') are coordinates obtained when an arbitrary position of (x_i, y_i, z_i) in the predetermined time intervals are projected onto the virtual handwriting plane, and a, b, c, and d are parameters for the virtual handwriting plane.

4. (canceled).

5. (currently amended): The spatial motion recognition system as claimed in claim [4]1, wherein the control unit calculates the rotation-converted tracks by the following equation:

$$\begin{bmatrix} x_i'' \\ y_i'' \\ z_i'' \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 \\ 0 & \cos\phi & -\sin\phi \\ 0 & \sin\phi & \cos\phi \end{bmatrix} \begin{bmatrix} \cos\theta & 0 & \sin\theta \\ 0 & 1 & 0 \\ -\sin\theta & 0 & \cos\theta \end{bmatrix} \begin{bmatrix} x_i' \\ y_i' \\ z_i' \end{bmatrix}$$

$$\phi = \arctan 2(-b, -c)$$

$$\theta = \arctan 2(a, \sqrt{b^2 + c^2})$$

wherein (x_i', y_i', z_i') are three-dimensional coordinates when the tracks are segmented in the predetermined time intervals and then the i^{th} position of (x_i, y_i, z_i) is projected on the virtual handwriting plane, and (x_i'', y_i'', z_i'') are coordinates of a point obtained when the i^{th} position of the projected tracks is rotated by θ degrees about the y axis and rotated by ϕ degrees about the x axis.

6. (currently amended): A spatial motion recognition method for a motion recognition system, comprising:

at least one control unit that implements the steps of:

obtaining three-dimensional track information on a system body in space;

producing a virtual handwriting plane virtually in three-dimensional space, wherein a location of the virtual handwriting plane is a plane which is most adjacent to a set of respective points which correspond ~~having the shortest distances with respect to respective positions corresponding~~ to the obtained three-dimensional track information of the system body in predetermined time intervals; and

projecting the ~~positions~~respective points corresponding to the tracked three-dimensional motions of the system body in the predetermined time intervals onto the virtual handwriting plane as motion tracks;~~and recovering the motions in space,~~

carrying out a rotation conversion of the motion tracks projected on the virtual handwriting plane into a two-dimensional plane of x and y axes; and

outputting the two-dimensional plane to a display unit for display,

~~wherein the virtual handwriting plane is determined based on the obtained three-dimensional track information of the system body~~.

7. (currently amended): ~~The~~a spatial motion recognition method for a motion recognition system ~~as claimed in claim 6~~, comprising:

at least one control unit that implements the steps of:

obtaining three-dimensional track information on a system body in space;

producing a virtual handwriting plane having the shortest distances with respect to respective positions in predetermined time intervals based on the obtained three-dimensional track information; and

projecting the positions in the predetermined time intervals onto the virtual handwriting plane and recovering the motions in space,

wherein the virtual handwriting plane is calculated by the following equation:

$$\begin{bmatrix} \sum_{i=1}^{m} x_i^2 & \sum_{i=1}^{m} x_i y_i & \sum_{i=1}^{m} x_i \\ \sum_{i=1}^{m} x_i y_i & \sum_{i=1}^{m} y_i^2 & \sum_{i=1}^{m} y_i \\ \sum_{i=1}^{m} x_i & \sum_{i=1}^{m} y_i & m \end{bmatrix} \begin{bmatrix} \alpha \\ \beta \\ \gamma \end{bmatrix} = \begin{bmatrix} \sum_{i=1}^{m} z_i x_i \\ \sum_{i=1}^{m} y_i z_i \\ \sum_{i=1}^{m} z_i \end{bmatrix}$$

wherein (x_i, y_i, z_i)are coordinates of the system body that is tracked at a predetermined time in the three-dimensional space, and α, β, and γ are parameters for the virtual handwriting plane.

8. (currently amended): ~~The~~A spatial motion recognition method~~ as claimed in claim 6~~ for a motion recognition system, comprising:

at least one control unit that implements the steps of:

obtaining three-dimensional track information on a system body in space;

producing a virtual handwriting plane having the shortest distances with respect to respective positions in predetermined time intervals based on the obtained three-dimensional track information; and

projecting the positions in the predetermined time intervals onto the virtual handwriting plane and recovering the motions in space

wherein the positions in the predetermined time intervals that are projected onto the virtual handwriting plane are calculated by the following equation:

$$x_i' = x_i - \frac{a(ax_i + by_i + cz_i + d)}{a^2 + b^2 + c^2}$$

$$y_i' = y_i - \frac{b(ax_i + bx_i + cz_i + d)}{a^2 + b^2 + c^2}$$

$$z_i' = z_i - \frac{c(ax_i + bx_i + cz_i + d)}{a^2 + b^2 + c^2}$$

wherein (x_i, y_i, z_i)are three-dimensional coordinates at a predetermined time tracked based on motion occurrences of the system body in the three-dimensional space, (x_i', y_i', zi')are coordinates obtained when an arbitrary position of (x_i, y_i, z_i) is projected onto the virtual handwriting plane, and a, b, c, and d are parameters for the virtual handwriting plane.

9. (canceled).

10. (currently amended): The spatial motion recognition method as claimed in claim ~~9~~6, wherein the rotation-converted tracks are calculated by the following equation:

$$\begin{bmatrix} x_i'' \\ y_i'' \\ z_i'' \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 \\ 0 & \cos\phi & -\sin\phi \\ 0 & \sin\phi & \cos\phi \end{bmatrix} \begin{bmatrix} \cos\theta & 0 & \sin\theta \\ 0 & 1 & 0 \\ -\sin\theta & 0 & \cos\theta \end{bmatrix} \begin{bmatrix} x_i' \\ y_i' \\ z_i' \end{bmatrix}$$

$$\phi = \arctan 2(-b, -c)$$

$$\theta = \arctan 2(a, \sqrt{b^2 + c^2})$$

wherein (x_i', y_i', z_i')are three-dimensional coordinates when the tracks are segmented in the predetermined time intervals and then the i^{th} position of (x_i, y_i, z_i) is projected on the virtual handwriting plane, and (x_i", y_i", z_i")are coordinates of a point obtained when the i^{th} position of the projected tracks is rotated by θ degrees about the y axis and rotated by ϕ degrees about the x axis.

11. (previously presented): The spatial motion recognition system as claimed in claim 1, wherein the control unit calculates the virtual handwriting plane by performing a linear regression operation.

12. (currently amended): The spatial motion recognition system as claimed in claim ~~11~~1, wherein the control unit calculates the virtual handwriting plane by performing ~~linear regression operation includes~~ a least squares regression operation.

13. (previously presented): The spatial motion recognition method as claimed in claim 6, wherein the virtual handwriting plane is determined by performing a linear regression operation.

14. (currently amended): The spatial motion recognition method as claimed in claim ~~13~~6, wherein the control unit calculates the virtual handwriting plane by performing~~linear regression operation includes~~ a least squares regression operation.

15. (previously presented): The spatial motion recognition system as claimed in claim 1, wherein the motion detection unit outputs position changes of the system body in space based on a continuous detection of the position changes of the system body using at least one gyro sensor and at least one acceleration sensor.

16. (previously presented): The spatial motion recognition method as claimed in claim 6, wherein the obtaining of the three-dimensional track information on the system body in space is based on a continuous detection of the position changes of the system body using at least one gyro sensor and at least one acceleration sensor.

17. and 18. (canceled).